

Stellar Astrophysics with ELT: some hints

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Stars as distance indicators: The Tip of the Red Giant Branch

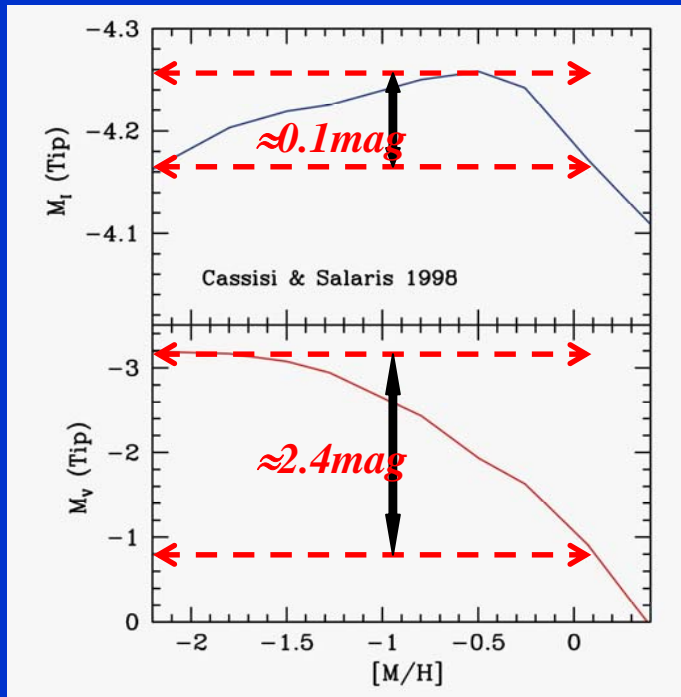
The ELT spatial resolution allows the opportunity to use traditional primary distance indicators at cosmological distances, thus improving the accuracy of distance measurements

The tip of the RGB represents one of the most accurate and reliable primary distance indicators. In particular the *I-Cousin* band magnitude of the RGB tip is a quite robust standard candle in a metallicity range of about 1.5dex

I-band TRGB distance estimates are routinely obtained for Local Group galaxies and the use of HST has allowed to apply this method to galaxies in Leo I group and in Virgo

The TRGB method appears well suited to the – low surface brightness – outskirts of galaxies, where crowding is not a thorny problem

The “Tip” of the RGB as standard candle



Advantages:

- It can be used for every Type of galaxy
- It can be measured from the RGB Luminosity Function
- It needs less telescope-time than variables stars
- Quite brighter ($\approx 4 \text{ mag}$) than RR Lyrae
- Marginal affected by interstellar extinction
- Almost independent on the metallicity

Drawbacks:

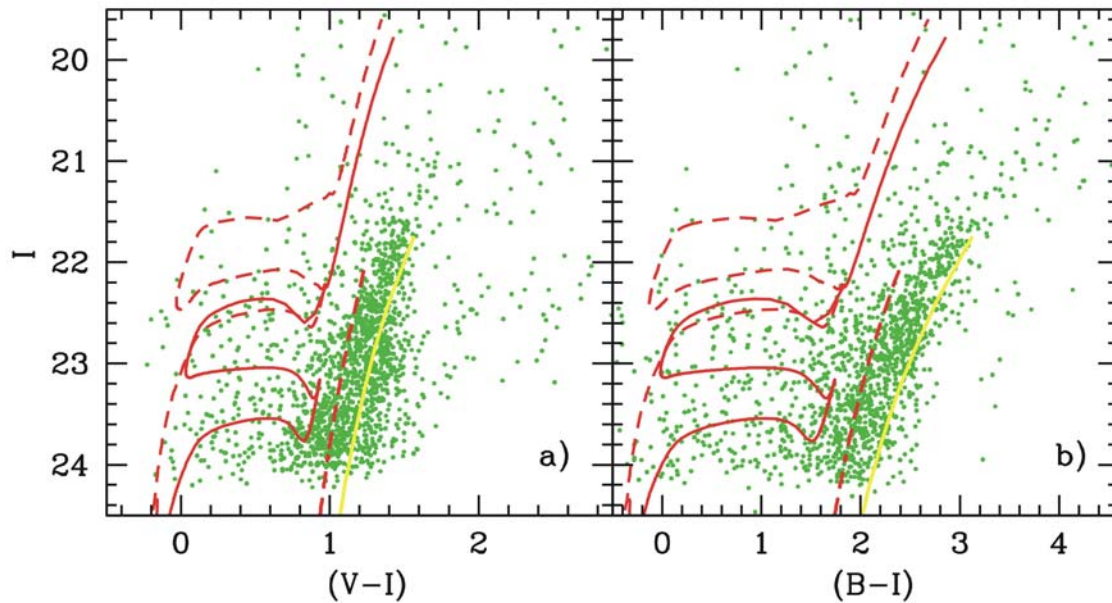
- Contamination problems related to AGB stars
- It needs a large sample of RGB stars

The RGB tip magnitudes: $M_V = -2 \text{ mag}$, $M_K = -6 \text{ mag}$, $M_I = -4 \text{ mag}$



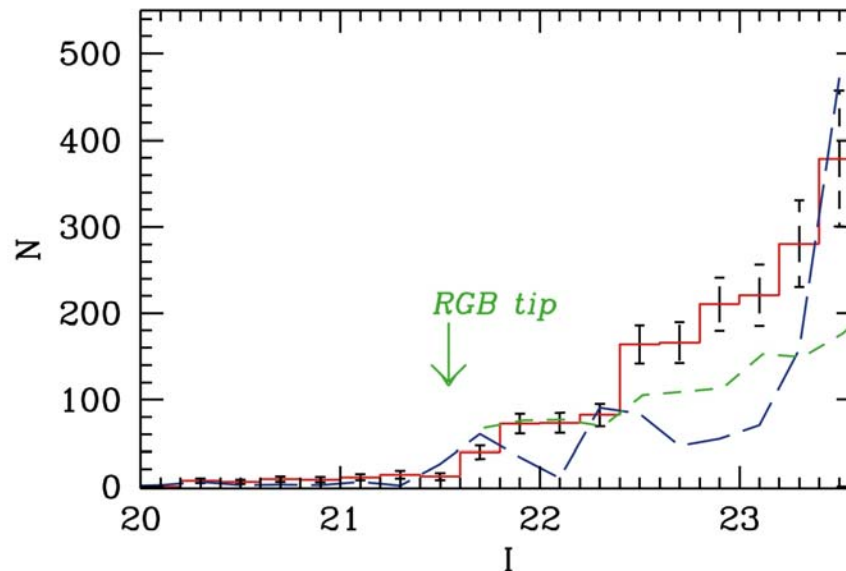
The TRGB method requires the measurement of RGB stars, about 1.5 mag below the RGB Tip. However, the Coma cluster is well within the range of a diffraction limited 100-m telescope

An application to the Dwarf Galaxy Antlia



VLT data

$(m-M)_0 = 25.89 \pm 0.10$ mag
 $D = 1.51 \pm 0.07$ Mpc



Cepheids & RR Lyrae with ELT

When assuming that the distance modulus to the Coma cluster is about 35 mag

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Being the absolute visual magnitude of Cepheids brighter than -2 in the short period range and approaches -6 in the long period range



ELT will offer the unprecedented opportunity to supply a complete census of Cepheids in a sizeable sample of large spiral galaxies belonging to this galaxy cluster

Since the Coma cluster does not seem to be affected by peculiar motions, typical of the local Universe, the new measurements will supply the relevant opportunity to provide an estimate of the Hubble constant only using a primary distance indicator

ELT should allow to measure the brightness of horizontal branch stars with an accuracy of about 10% within a limiting distance of about 31-32 mag in the V band, and about 28-29 mag in the K band in spiral galaxies and of about 36/33 mag (V/K band) in elliptical Galaxies

**This occurrence will allow the detection of
HB stars and RR Lyrae variables
in several giant spiral and elliptical galaxies in the Virgo cluster**



A check of the accuracy of type Ia Supernovae as secondary distance indicators

Cepheids have been already used BUT ONLY for SNIa in spiral galaxies

The presence of RR Lyrae stars in both elliptical & spiral galaxies will provide the unique opportunity to constrain on a quantitative basis whether the peak luminosity of SN Ia does depend on the host galaxy